Family list
2 application(s) for: **JP2003115379**

1 **ORGANIC EL ELEMENT MANUFACTURING EQUIPMENT**

Inventor: CHIN KAFU
Applicant: KIKO KENJI KAGI KOFUN YUGENKOS
EC:
IPC: ***H05B33/10; C23C14/00; C23C14/12;*** (+16)

Publication info: **JP2003115379 (A)** — 2003-04-18

2 **The manufacturing apparatus of organic light-emitting diode (OLED) devices**

Inventor: CHEN HWA-FU [TW]
Applicant: LIGHT DISPLAY CORP G [TW]
EC:
IPC: ***H05B33/10; C23C14/00; C23C14/12;*** (+13)

Publication info: **TW550967 (B)** — 2003-09-01

PAT-NO: JP02003115379A

DOCUMENT-IDENTIFIER: JP 2003115379 A

TITLE: ORGANIC EL ELEMENT MANUFACTURING EQUIPMENT

PUBN-DATE: April 18, 2003

INVENTOR-INFORMATION:

NAME	COUNTRY
CHIN, KAFU	N/A

INT-CL (IPC): H05B033/10, C23C014/12 , C23C014/24 , G09F009/00 , H05B033/14

ABSTRACT:

PROBLEM TO BE SOLVED: To provide evaporation cell supplement equipment of organic EL element manufacturing equipment, which can reduce the manufacturing cost of the organic EL elements by improving the operation efficiency of the manufacturing equipment by filling up the evaporation cells, while maintaining the vacuum of a vacuum chamber without stopping operation of the equipment.

SOLUTION: The evaporation cell 4 is installed in a conveyance stand 63 accommodated in a supplement tub 61. The supplement tub 61 is intercepted in airtight to the exterior and the vacuum chamber 2, and it becomes possible to be vacuumed again. When a gate valve 84 is opened and a passage 69, which is between the supplement tub 61 and the vacuum chamber 2 is opened, the conveyance stand 63 is carried horizontally to an advanced position in the vacuum chamber 2 from a charge position in the supplement tub 61 by the operation of a driving mechanism 70, which has a rack 74 and a pinion 73. A fitting part 21 of a drive means 5, which operates in the direction of length, fits to the evaporation cell 4 installed in the conveyance stand 63, and it can move to a heating position or a cooling position.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The driving means which you have [driving means] the engagement section which engages with the evaporation cel in which the organic raw material is held possible [balking], and makes it go up and down said evaporation cel to a rise location, And it has a heating means to heat said evaporation cel which occupies said rise location in order to evaporate said organic raw material. In the organic EL device manufacturing installation to which the vacuum evaporationo to the substrate of said organic raw material which evaporated from said evaporation cel is performed inside a vacuum chamber While being attached in said vacuum chamber, the interior can be vacuated and the exterior and said vacuum chamber are received. The supplement tub which can be closed in the seal condition, respectively, The conveyance base which has the installation section which lays said evaporation cel for a supplement in a positioning condition while being able to hold in said supplement tub, And it has the drive which conveys said conveyance base possible [a round trip] between the loading location in said supplement tub, and the advance location in said vacuum chamber. Said driving means can descend to the downward location of the lower part of said conveyance base conveyed in said engagement section in said advance location. Said evaporation cel The organic EL device manufacturing installation change from engaging with said engagement section which carries out rise passage of said conveyance base, and it being raised from said installation section, carrying out engagement balking from said engagement section which carries out downward passage of said conveyance base, and residual installation being carried out at said installation section.
[Claim 2] The organic EL device manufacturing installation according to claim 1 which consists of the closing motion door which permits receipts and payments of said evaporation cel from the outside to said supplement tub, and which can be sealed being prepared in said supplement tub, and the gate valve which can be switched between the closed states which change sealing cutoff into the open condition of permitting passage of said conveyance base being prepared between said vacuum chambers and said supplement tubs.
[Claim 3] It is the organic EL device manufacturing installation according to claim 1 or 2 which **** said conveyance base in the conveyance direction, can lay said evaporation cel of two or more trains, and consists of being set as two or more locations corresponding to said advance location of said conveyance base being conveyed to the location as for which said evaporation cel carries out engagement or engagement balking with said engagement section of said driving means for said every train.
[Claim 4] It is an organic EL device manufacturing installation given in any 1 term of claims 1-3 which said conveyance base is supported with two or more rollers which can rotate freely, and consist of having the drive motor which drives the pinion which said drive is supported free [the rotation to the rack currently formed in the flank of said conveyance base, and said supplement tub], and gears on said rack, and said pinion.
[Claim 5] An organic EL device manufacturing installation given in any 1 term of claims 1-4 which change from the receptacle section which supports the point of said conveyance base conveyed in said

vacuum chamber being arranged to said vacuum chamber.
[Claim 6] It is an organic EL device manufacturing installation given in any 1 term of claims 1-5 which consist of the through tube which said engagement section of said driving means can pass being formed although passage of said evaporation cel is not permitted in said installation section of said conveyance base by said evaporation cel's holding said organic raw material in the interior, and consisting of the tubed container which has the pars basilaris ossis occipitalis with which said engagement section of said driving means can engage.
[Claim 7] An organic EL device manufacturing installation given in any 1 term of claims 1-6 which consist of a cel cooling means to cool said evaporation cel being established in the vertical direction mid-position between said rise location and said advance location where said conveyance base was conveyed.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the organic EL device manufacturing installation which enabled the supplement of an evaporation cel, even if an organic EL device manufacturing installation is working in the organic EL device manufacturing installation which forms an organic thin film on a substrate with the vacuum deposition which makes the evaporative gas of the organic raw material which heated the evaporation cel and was produced adhere on a substrate.
[0002]
[Description of the Prior Art] An organic EL device like an organic electroluminescence (electroluminescence) display is the field luminescence display device of all solid-state molds in a thin shape, and since a back light is unnecessary, there is little power consumption, it is reliable and the high definition and the high-definition display of high contrast are possible, its attention is paid to it in the field of the display in recent years. The organic EL device is equipped with the metal electrode which turns into cathode on substrates, such as a printed-circuit board, at the time of completion by vapor-depositing a metallic material on the organic thin film and the organic thin film of the organic EL device used as the transparent electrode which turns into an anode plate at the time of completion, and the luminous layer formed on the transparent electrode. Such an organic EL device is manufactured by forming a metal electrode and a transparent electrode by the vacuum deposition method or the sputtering method, and forming an organic thin film with a vacuum deposition method.
[0003] Vacuum deposition of an organic thin film is performed by making the gas organic raw material which the evaporation source which held the organic raw material which is a vacuum evaporationo ingredient in the interior was heated within the vacuum tub, and the organic material was evaporated, and evaporated adhere to the downward vapor-deposited field of the substrate arranged above an evaporation source, and making it specifically form. An evaporation source can be used as the evaporation cel which held the organic raw material, for example, was formed from a container like the crucible formed from proper ingredients, such as a ceramic and clear glass. The movable shutter for controlling vacuum evaporationo is formed in right above [of an evaporation cel], or the location [directly under] of a substrate. It prevents that the emission which contained the impurity by making a movable shutter into a closed state adheres to a substrate in early stages of vacuum evaporationo, and a movable shutter is opened after fixed time amount progress from which the vapor rate of a raw material became fixed, and where control of an evaporation rate is stabilized, membrane formation to the vapor-deposited field of a substrate is performed. An organic thin film is fabricated by the predetermined pattern by vapor-depositing in the condition of having arranged the predetermined mask on a substrate at every membrane formation.
[0004] As one approach of heating an organic raw material indirectly and gasifying it, a raw material container is formed by crucible, a heater is formed in that perimeter, and there is a method of heating crucible by energizing at this heater. Moreover, metallic materials, such as a tungsten with the high melting point, a tantalum, and molybdenum, are processed in the shape of sheet metal as resistance

heating vacuum deposition, a raw material container is manufactured from the metal plate which made electric resistance high, and there is also a method of evaporating an organic raw material by making a direct current pass and generate heat in the raw material container. Since the structure of a manufacturing installation becomes simply cheap, this approach has spread in a vacuum deposition method. As approaches other than the approach of heating an organic raw material indirectly, an electron beam and a laser beam are irradiated directly at a raw material, and there is electron beam laser-beam vacuum deposition which evaporates a raw material with the energy.

[0005] When having evaporated conventionally the organic raw material contained in an evaporation cel, supplement and exchange of an evaporation cel are performed by collecting the containers of the evaporation cel arranged in the predetermined location in a vacuum chamber, and loading the above-mentioned predetermined location with the evaporation cel in which a new organic raw material was held. Since a new evaporation cel is put on the exterior of an organic EL device manufacturing installation, after once canceling the vacuum in a vacuum chamber and performing supplement and exchange of an evaporation cel on the occasion of a supplement and exchange of an evaporation cel, the inside of a vacuum chamber is vacuated again. Among this activity, especially re-vacuation of a vacuum chamber required time amount, and has barred efficient operation of an organic EL device manufacturing installation.

[0006] Since the organic material is very expensive, in order to supply an organic EL device cheaply, it is important to reduce the manufacturing cost of an organic EL device, and it is required to operate a manufacturing installation continuously and to manufacture as many organic EL devices as possible during continuous running of the once of a manufacturing installation especially. That is, if a manufacturing installation is frequently stopped in order to perform a supplement and exchange of an organic raw material since evaporation of an organic raw material is performed within the chamber of the manufacturing installation highly made into the vacua, whenever [the], vacuum discharge and re-vacuation of a vacuum chamber will be needed, the operation effectiveness of equipment will get worse, and product cost will go up. Therefore, even if it is the case where the cel mold evaporation source which can hold at once comparatively a lot of amounts of raw materials is used, it is desirable to vapor-deposit to a substrate continuously by the vacuum tub of the manufacturing installation once made into the vacuum.

[0007] Two or more crucibles with which the organic material was filled up into the hold interior of a room separated possible [a vacuum chamber and cutoff] with the gate valve are prepared, any one of the crucibles of these is chosen, and an example of an organic thin film deposition system which attached the crucible in the evaporation source in a vacuum chamber (source of heating) by the carrier-robot device in which it has a hand and an arm is indicated by JP,2000-223269,A. A carrier-robot device has complicated structure, and it passes in a vacuum chamber, and conveyance of a crucible is restricted to one piece at once. Since an evaporation source cannot change a height location, either, flexibility corresponding to cooling of an evaporation source etc. is not expectable.

[0008]

[Problem(s) to be Solved by the Invention] As mentioned above, in suspending operation of a manufacturing installation at every supplement of an evaporation cel, and canceling the vacuum of a vacuum chamber to it about manufacture of an organic EL device, it is necessary to vacuate a vacuum chamber again after exchange and a supplement of an evaporation cel, operation effectiveness of a manufacturing installation cannot improve, and the manufacturing cost of an organic EL device cannot be reduced. Moreover, while the manufacture cost of a manufacturing installation goes up that the device to which the evaporation cel after a supplement is moved to a heating location is complicated, operation effectiveness does not improve, either, but the manufacturing cost of an organic EL device is raised further as a result. Therefore, supply is made possible for an evaporation cel into a vacuum chamber from the exterior, an evaporation cel is filled up, not stopping operation of the manufacturing installation of an organic EL device, and maintaining the vacuum of a vacuum chamber, and the technical problem which should be solved at the point to which it is an easy device to a heating location, and the evaporation cel after a supplement is moved promptly occurs.

[0009] The purpose of this invention has maintained the vacuum of a vacuum chamber about manufacture of an organic EL device, without suspending operation of a manufacturing installation. By supplying an evaporation cel in a vacuum chamber from the exterior, filling up an evaporation cel, and moving an evaporation cel even to a heating location promptly after a supplement It is offering the organic EL device manufacturing installation which enables the restart at an early stage of both evaporation of an organic raw material, and makes possible the thing which improve the operation effectiveness of a manufacturing installation, and for which an organic EL device's is manufactured cheaply.

[0010]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the organic EL device manufacturing installation by this invention The driving means which you have [driving means] the engagement section which engages with the evaporation cel in which the organic raw material is held possible [balking], and makes it go up and down said evaporation cel to a rise location, And it has a heating means to heat said evaporation cel which occupies said rise location in order to evaporate said organic raw material. In the organic EL device manufacturing installation to which the vacuum evaporationo to the substrate of said organic raw material which evaporated from said evaporation cel is performed inside a vacuum chamber While being attached in said vacuum chamber, the interior can be vacuated and the exterior and said vacuum chamber are received. The supplement tub which can be closed in the seal condition, respectively, The conveyance base which has the installation section which lays said evaporation cel for a supplement in a positioning condition while being able to hold in said supplement tub, And it has the drive which conveys said conveyance base possible [a round trip] between the loading location in said supplement tub, and the advance location in said vacuum chamber. Said driving means can descend to the downward location of the lower part of said conveyance base conveyed in said engagement section in said advance location. Said evaporation cel It changes from engaging with said engagement section which carries out rise passage of said conveyance base, and it being raised from said installation section, carrying out engagement balking from said engagement section which carries out downward passage of said conveyance base, and residual installation being carried out at said installation section.

[0011] Thus, according to the constituted organic EL device manufacturing installation, the engagement section which goes up by actuation to a driving means can engage with an evaporation cel, the stop section can be passed, and an evaporation cel goes up further and is carried to a rise location by the engagement section. The gas organic raw material which evaporated from the evaporation cel by being heated by the heating means in a rise location is vapor-deposited by adhering to the bottom side of the substrate arranged at the vacuum chamber bottom. Since heating of the evaporation cel by the heating means is performed quickly, the amount to which an organic raw material becomes useless is used efficiently few. When dropping an evaporation cel to the downward location of a conveyance base and carrying out downward passage of the conveyance base, a driving means leaves a used evaporation cel to the installation section on a conveyance base, and is made to lay, if the organic raw material of an evaporation cel has evaporated. When supplementing an organic EL device manufacturing installation with an evaporation cel, between vacuum chambers is made into a seal condition, an evaporation cel is supplied to a supplement tub from the exterior, a supplement tub is vacuated, and then between a supplement tub and vacuum chambers is opened for traffic by making between the exteriors into a seal condition. When exchanging an evaporation cel, it advances to a conveyance base in a vacuum chamber, and a new evaporation cel engages with the engagement section of a driving means, and goes up in the condition by the driving means. On the occasion of supply to the supplement tub of an evaporation cel, an evaporation cel is laid in the conveyance base held in the supplement tub by the detail. When the conveyance base is already held in the supplement tub, an evaporation cel is immediately laid in a conveyance base. Since a supplement tub is airtightly intercepted to the exterior and a vacuum chamber, it becomes possible for the interior to re-vacuate it. if between a supplement tub and vacuum chambers is opened for traffic, passage of a conveyance base is possible -- becoming -- a conveyance base -- actuation of a drive -- from the loading location in a supplement tub -- since -- it is conveyed in the

advance location in a vacuum chamber. When conveying a conveyance base toward the inside of a vacuum chamber with a drive, by controlling the advance location of a conveyance base, the location occupied within an organic EL device manufacturing installation becomes controllable correctly, and for exchange, the evaporation cel currently laid in the conveyance base by the positioning condition is received from the installation section on a conveyance base to the engagement section of a driving means, and is passed.

[0012] In this organic EL device manufacturing installation, the closing motion door which permits receipts and payments of said evaporation cel from the outside to said supplement tub and which can be sealed is prepared in said supplement tub, and the gate valve which can be switched between the closed states which change sealing cutoff into the open condition of permitting passage of said conveyance base is prepared between said vacuum chambers and said supplement tubs. The closing motion door prepared between the exterior and a supplement layer is opened at the time of supply in the supplement layer of an evaporation cel, and then, in order to maintain the vacuum in a vacuum chamber, the gate valve is closed. The gate valve prepared between the vacuum chamber and the supplement tub is opened only when the supplement tub which closed the closing motion door and was made into the seal condition is a vacua. the gate valve with which the conveyance base is in the open condition -- letting it pass -- actuation of a drive -- from the loading location in a supplement tub -- since -- it is conveyed in the advance location in a vacuum chamber.

[0013] In this organic EL device manufacturing installation, said conveyance base is ****(ed) in the conveyance direction, said evaporation cel of two or more trains can be laid, and said advance location of said conveyance base is set up as two or more locations corresponding to being conveyed to the location as for which said evaporation cel carries out engagement or engagement balking with said engagement section of said driving means for said every train. By ****(ing) in the conveyance direction and laying the evaporation cel of two or more trains in a conveyance base, it is one supplement of the evaporation cel to a supplement tub with a conveyance base, and it is possible in an organic EL device manufacturing installation only for the number of the trains laid in the conveyance base to use an evaporation cel over multiple times, carrying out sequential exchange. Exchange of an evaporation cel makes delivery and two or more advance locations set up beforehand carry out a sequential halt of the conveyance base within a vacuum chamber by conveyance of a drive at the time of the exchange. At this time, the evaporation cel of two or more trains laid in the conveyance base is moved one after another to the location which engages or breaks away [engagement] with the engagement section of a driving means.

[0014] In this organic EL device manufacturing installation, said conveyance base is supported with two or more rollers which can rotate freely, and said drive is equipped with the drive motor which drives the rack currently formed in the flank of said conveyance base, the pinion which is supported by said supplement tub free [rotation] and gears on said rack, and said pinion. Since the conveyance base is supported with two or more rollers which can rotate freely, when a conveyance base is conveyed, the rolling resistance of a conveyance base will become small as much as possible. Moreover, when a drive has the rack currently formed in the flank of the conveyance base where this pinion gears with the pinion which the driving force of a drive motor is delivered as a configuration which changes rotation into reciprocation, it becomes simply certain operating the structure of a drive structural.

[0015] In this organic EL device manufacturing installation, it is desirable to arrange the receptacle section which supports the point of said conveyance base conveyed in said vacuum chamber to said vacuum chamber. Since a point receives a conveyance base and it is supported in the section when it marches out in a vacuum chamber from a supplement tub, it does not have un-arranging [of inclining with a self-weight]. In the receptacle section, in order to support by low friction, it is desirable to support the inferior surface of tongue of a conveyance base with a roller.

[0016] In this organic EL device manufacturing installation, about said evaporation cel, said organic raw material is held in the interior, and it constitutes from a tubed container which has the pars basilaris ossis occipitalis with which said engagement section of said driving means can engage, and although passage of said evaporation cel is not permitted in said installation section of said conveyance base, it is

desirable in it to form the through tube which said engagement section of said driving means can pass. It is in agreement with the rise-and-fall location of the anchoring section where the location of the through tube of the installation section by which the conveyance base conveyed by the drive for an evaporation cel supplement is established in the conveyance base in the advance location which will be occupied within a vacuum chamber is established in the point of a driving means. Moreover, it is desirable when making the conveyance direction of a conveyance base horizontal and carrying out a rectangular crossover with the rise-and-fall direction of the perpendicular direction of the engagement section of a driving means makes the engagement section of a driving means engaged to the evaporation cel which performed location indexing of a conveyance base or was laid in the installation section of a conveyance base.

[0017] In this organic EL device manufacturing installation, a cel cooling means to cool said evaporation cel can be established in the vertical direction mid-position between said rise location and said advance location where said conveyance base was conveyed. After vacuum evaporationo of the organic raw material to a substrate is completed, heating of the evaporation cel by the heating means is suspended, and an evaporation cel descends to the mid-position by the driving means, and is cooled by the cel cooling means. The temperature of an evaporation cel falls quickly and evaporation of the organic raw material from an evaporation cel stops it quickly. Although heating and cooling of an evaporation cel are performed in a different location which an evaporation cel occupies, respectively, since migration between each of these locations of an evaporation cel is performed smoothly quickly by simple rise-and-fall actuation of a driving means and it does not interfere in a heating means and a cel cooling means mutually, the structure of an organic EL device manufacturing installation becomes easy, and operation effectiveness improves. Moreover, since cooling of the evaporation cel by the cooling means is performed quickly, the amount to which an organic raw material becomes useless is used efficiently few.

[0018]

[Embodiment of the Invention] Hereafter, the example of the organic EL device manufacturing installation by this invention is explained, referring to an accompanying drawing. Drawing of longitudinal section showing one example of the organic EL device manufacturing installation according [drawing 1] to this invention, Drawing 2 is drawing of longitudinal section showing an example of the cooling means used for an organic EL device manufacturing installation. The A-A sectional view of drawing 3 , The top view cut by flat-surface B-B of the cooling means which shows drawing 3 in drawing 2 , and drawing 4 are drawings of longitudinal section showing the evaporation cel supplement device of an organic EL device manufacturing installation shown in drawing 1 . The C-C sectional view of drawing 5 , The sectional view cut by flat-surface D-D of the evaporation cel supplement device which shows drawing 5 in drawing 4 , and drawing 6 are the sectional views cut by flat-surface E-E of the evaporation cel supplement device shown in drawing 4 .

[0019] The vacuum chamber 2 by which the manufacturing installation 1 of the organic EL device shown in drawing 1 was supported by the equipment frame, The evaporation cylinder 3 by which the substrate 8 which is arranged every length in the vacuum chamber 2 at a condition, and should form membranes to upper limit is arranged, It has the tubed container which can hold the organic raw material 9 (refer to drawing 2 and drawing 3) which a substrate 8 should be made to vapor-deposit. And the rise location U in the evaporation cylinder 3 The evaporation cel 4 which can be located between the downward location L of the lower part of a conveyance base (it mentions later) and the rise location U, and the downward location L, and can move up and down between the mid-position M besides the evaporation cylinder 3, It has a heating means 6 to heat the evaporation cel 4 which occupies the rise location U in order to evaporate the driving means 5 which moves the evaporation cel 4 up and down, and the organic raw material 9 held in the evaporation cel 4, and a cel cooling means 7 to cool the evaporation cel 4 which occupies the mid-position M.

[0020] The vacuum chamber 2 has the proper configuration and is installed on **** by the equipment frame 10. The interior 11 of the vacuum chamber 2 is maintained by the usually advanced vacua with the vacuum suction means (cryopump) which is not illustrated. Although not illustrated in the vacuum

chamber 2, the proof-pressure glass window which can be looked [11] in can be prepared in a proper location. The evaporation cylinder 3 is installed in the interior 11 of the vacuum chamber 2, after having been supported by the support saddle 12. The evaporation cylinder 3 consists of barrels carried out every [which consists of a metal with high thermal conductivity like copper] length, such as an rectangular pipe object and a cylinder object, and upper limit and a lower limit serve as Openings 25a and 25b, respectively. The evaporation cylinder 3 is serving to show to going up the organic material gas (henceforth "evaporative gas") which the evaporation cel 4 evaporated toward a substrate 8. In the example of illustration, although only one evaporation cylinder 3 is held in the vacuum chamber 2, two or more evaporation cylinders 3 may be put in order and held. In this case, in each evaporation cylinder 3, although the above-mentioned evaporation cel, a driving means 5, the cel cooling means 7, and the evaporation cel supplement equipment mentioned later are arranged, the organic raw material 9 held in each evaporation cel 4 can be used as the raw material of different species at the order vapor-deposited to a substrate 8.

[0021] As for the evaporation cel 4, it is desirable to consider as the transparent glass crucible in which upper limit carried out opening in order to enable a check by looking of the residue of an organic raw material from the exterior especially. The heating means 6 is attached in the evaporation cylinder 3, and when the evaporation cel 4 goes up in the rise location U in the evaporation cylinder 3 by the driving means 5, the evaporation cel 4 will be in the condition of having been surrounded although not attached in the heating means 6. The heating means 6 is an indirect heating means to have the configuration of the tubed heater equipped with the resistance heating line by which a power source is supplied through the electric wire (not shown) prolonged from the outside of the vacuum chamber 2, and in order to evaporate the organic raw material 9 held in the evaporation cel 4, it heats the evaporation cel 4 even from a perimeter to 200 degrees C - 300 degrees C.

[0022] The driving means 5 is formed at the tip of a motor 15, the belt-transmission device 16 in which the rotation output of a motor 15 is transmitted, the splice 17 that tells rotation of the output side of the belt-transmission device 16, the **** shaft 18 which rotates with a splice 17, the ball nut 19 screwed in the **** shaft 18, the climbing-shaft object 20 attached in the ball nut 19, and the climbing-shaft object 20, and has the evaporation cel 4 and the engagement section 21 which can be engaged. The driving means 5 has the case 22 which encloses the structure from the splice 17 to the engagement section 21 in the seal condition, and maintains the vacuum inside [11] the vacuum chamber 2 again. Furthermore, the slit 23 of the pair prolonged in a lengthwise direction is formed in the climbing-shaft object 20, and the regulation piece 24 attached in the vacuum chamber 2 is engaging with the slit 23. Therefore, rotation of a motor 15 is ****ed through the belt transmission device 16 and a splice 17, it is transmitted to a shaft 18, and the rise-and-fall drive of the climbing-shaft object 20 is carried out by screw-thread operation with the ball nut 19 in which rotation regulation is carried out by the **** shaft 18 and the regulation piece 24. Rise and fall of the climbing-shaft object 20 become settled according to the hand of cut of a motor 15. The illustrated driving means 5 is an example and it cannot be overemphasized that the actuator which consists of an air cylinder etc. is employable.

[0023] Above opening 25a of the evaporation cylinder 3 top, opening 25a is approached and the shutter 26 which can be opened and closed is arranged. By being able to establish a drive 5 and the same device as an object for closing motion actuation of a shutter 26 behind the shutter attitude path 27 connected to the vacuum chamber 2, and operating this device, a shutter 26 can be made to be able to move at the shutter attitude path 27, and closing motion actuation of a shutter 26 can be performed. A shutter 26 is closing in addition to a vacuum evaporationo period, and has prevented that evaporative gas goes up further and adheres toward a substrate 8 from the evaporation cylinder 3. You may make it prevent further the vacuum evaporationo to the substrate 8 by the evaporative gas of the time of evaporation initiation with high possibility that an impurity is included, by forming a shutter (not shown) also directly under a substrate 8.

[0024] The substrate holder 28 is attached in upper wall section 2a of the vacuum chamber 2 in right above [of a shutter 26], and the substrate 8 conveyed by the conveyance means 30 is held in the location right above the evaporation cylinder 3 by being inserted by the holder 29 which cooperates with

the substrate holder 28 and the substrate holder 28. The mask 31 which has the predetermined pattern of the substrate holder 28 in a lower part can be held with the mask holder 32, and only the exposed part of the substrate 8 according to the pattern of a mask 31 can be made to vapor-deposit an organic material immediately. The actuation shafts 33 and 34 which penetrate upper wall section 2a of the vacuum chamber 2 in the seal condition can perform actuation of a holder 29 and the mask holder 32.
[0025] As shown in drawing 2 and drawing 3 , the cel cooling means 7 is equipped with the cel cooling objects 40 and 40 which can approach from the side to the evaporation cel 4 which occupies the mid-position M. As for the cel cooling objects 40 and 40, it is desirable to consider as the copper case where thermal conductivity is high so that heat can be promptly taken from the evaporation cel 4 in the state of approach. In the lower limit of the evaporation cel 4, the bearing bar 36 which carries out insertion engagement is projected and attached in the support hole 35 currently formed in the supporter 21 of a driving means 5. Each cel cooling object 40 is equipped with the half-tubed curve side 41 which encloses the one half of the outer case side 37 of the evaporation cel 4 in the side which faces the evaporation cel 4, and the shelf 42 which has the shelf surface 43 of the shape of a sector corresponding to the base 38 of the evaporation cel 4 in the bottom section. When the shelf surface 43 of a shelf 42 carries the base 38 of the evaporation cel 4, each cel cooling object 40 is stabilized, and can hold the evaporation cel 4, and can cool the evaporation cel 4 also from a base 38.
[0026] cooling from the heat exchange machine 50 (refer to drawing 1) with which the cooling water of 3 times Centigrade - 4 times as a cooling medium is arranged in the exterior of the vacuum chamber 2 -- it flows into the cooling room 44 currently formed in the interior of each cel cooling object 40 through the supply pipe 45 as a conduit, and returns to the heat exchange machine 50 through a return pipe 46. The supply pipe 45 and the return pipe 46 have penetrated peripheral wall section 2b of the vacuum chamber 2 in the seal condition, serve as the connection section prolonged even in the air actuators 47 and 47 (only one side is illustrated) as an operation system currently arranged in the outside of the vacuum chamber 2, can drive it with air actuators 47 and 47, and each cel cooling object 40 can be made to move to the evaporation cel 4, as shown in drawing 1 R> 1.
[0027] When stopping vacuum evaporationo of the organic raw material to a substrate 8, while stopping the energization to the heating means 6, the evaporation cel 4 is dropped to the mid-position M by the driving means 5, the air actuators 47 and 47 as an operation system are operated, and the cel cooling objects 40 and 40 are made to march out to the evaporation cel 4. The cel cooling objects 40 and 40 close to the evaporation cel 4 start cooling by taking heat from the evaporation cel 4, and stop evaporation of an organic raw material immediately. Consequently, evaporation of an expensive organic raw material can stop, it can become possible to hold down useless consumption of the organic raw material diffused without being vapor-deposited by the substrate 8, and to use an organic raw material efficiently, and the manufacturing cost of an organic EL device can be reduced.
[0028] Evaporative gas flows out toward a substrate 8 by opening a shutter 26. About the evaporative gas which it is going to diffuse in the vacuum chamber 2 from opening 25b of the evaporative gas and evaporation cylinder 3 bottom which have stopped in the evaporation cylinder 3, recovery is achieved by cooling the evaporation cylinder 3 by making it sublimate to inside 3a of the evaporation cylinder 3 directly. That is, in order to cool the evaporation cylinder 3, the cooling means 54 by this invention is established in relation to the evaporation cylinder 3. cooling connected to the cooling section 55 in order for the cooling means 54 to circulate a cooling medium between the cooling section 55 which has the annular configuration where lower limit section 3b of the evaporation cylinder 3 was met, and is attached in lower limit section 3b, and the heat exchange machine 50 currently arranged in the cooling section 55 and the exterior of the vacuum chamber 2, as shown in drawing 1 -- it has conduits 56 and 57. A cooling medium can be used as cooling water of 3 times Centigrade - 4 times like the case of the cel cooling means 7. cooling -- conduits 56 and 57 penetrate peripheral wall section 2b of the vacuum chamber 2 in the seal condition, and are formed. By cooling the evaporation cylinder 3, it is made to sublimate the evaporative gas in the evaporation cylinder 3 to inside 3a of the evaporation cylinder 3 directly, and it adheres to it. Suitably, by shaving [a / inside 3] solid organic raw materials which took out the evaporation cylinder 3 from the vacuum chamber 2 at the stage, and were sublimated, such as

maintenance check of a manufacturing installation 1, organic raw materials can be collected and reuse can be presented.
[0029] As shown in drawing 4 - drawing 6 , the evaporation cel supplement device 60 in the organic EL device manufacturing installation 1 is equipped with the supplement tub 61 attached in the flank of the vacuum chamber 2 bottom, and the supplement tub 61 has the tooth space in which the conveyance base 63 which can be laid in a positioning condition can be held for the evaporation cel 4 for a supplement in the interior 62. Since the vacuum in the vacuum chamber 2 is maintained at the time of connection with the vacuum chamber 2, the interior 62 of the supplement tub 61 can be vacuated through the siphon 64 (drawing 4) attached in bottom wall 61a of the supplement tub 61. In vacuation of the supplement tub 61, it can use with the vacuum pump for vacuating the vacuum chamber 2 in common.
[0030] The base materials 65 and 65 of a pair are formed in the interior 62 of the supplement tub 61 along the conveyance direction of the conveyance base 63, and the conveyance base 63 is supported with two or more support rollers 66 formed in the location which ****(ed) at equal intervals to each base material 65 free [the rotation to the circumference of an axis of abscissa]. The train (it is left-hand side at drawing 6) of one support roller 66 is supporting the conveyance base 63 directly, and the train (it is right-hand side at drawing 6) of the support roller 66 of another side is supporting the conveyance base 63 indirectly through the rack member mentioned later. As for the train of each support roller 66, only the thickness of a rack member has a level difference up and down, and the conveyance base 63 is supported by the level condition. When two or more guide rollers 67 **** to base materials 65 and 65, and it is arranged in the circumference of an axis of ordinate free [rotation], each guide roller 67 is regulated so that the conveyance base 63 may not carry out a horizontal deflection in contact with the side faces 68 and 68 of the conveyance base 63, and the conveyance base 63 is conveyed, the conveyance is guided by rolling to side faces 68 and 68. The path 69 is formed between the vacuum chamber 2 and the supplement tub 61, a path 69 can be opened and closed with the gate valve 84 mentioned later, and its conveyance base 63 is movable through a path 69 in the state of open [of a gate valve 84].
[0031] In order to convey the conveyance base 63 possible [reciprocation] between the loading location in the supplement tub 61, and the advance location in the vacuum chamber 2, the conveyance base 63 is established in the drive 70 for a drive by the supplement tub 61. The drive 70 consists of an electric motor 71 like the servo motor formed in the exterior of the supplement tub 61, an output shaft 72 which is penetrated and prolonged in the seal condition and drives bottom wall 61a of the supplement tub 61 with an electric motor 71, a pinion 73 attached at the tip of an output shaft 72, and a rack 74 with which the gear tooth which is formed in one flank of the conveyance base 63, and gears with a pinion 73 was formed. In a drive 70, operation of an electric motor 71 changes rotation of an output shaft 72 into the rectilinear motion of the conveyance base 63 through engagement engagement of a pinion 73 and a rack 74. The structure of a drive 70 is simply constituted by engagement engagement of a pinion 73 and a rack 74, and actuation becomes certain by it. In the conveyance base 63, since it is conveyed being regulated by the support roller 66 and the guide roller 67 in a longitudinal direction and the vertical direction, and rotating the support roller 66 and a guide roller 67 when driving with a drive 70, the conveyance base 63 runs smoothly.
[0032] In the mode which exchanges the used evaporation cel 4 and the intact evaporation cel 4, in the evaporation cel 4, since the receipts and payments to the supplement tub 61 are permitted, the closing motion door 80 which can be sealed is formed in the supplement tub 61. That is, the wide mouth hole 81 is formed in upper wall 61b of the supplement tub 61 over almost all the breadth, and the wide mouth hole 81 is formed in the closing motion door 80 as a wrap lid. The magnitude of the wide mouth hole 81 is the magnitude with which can take out conveyance base 63 the very thing, or the time of assembly can be equipped. The closing motion door 80 is attached in the supplement tub 61 by the fixture 82 at a sticking-by-pressure condition. When vacuating the interior 62 of the supplement tub 61, in order to maintain seal between the closing motion doors 80 and the exteriors which were closed, O ring 83 is arranged in the surroundings of the wide mouth hole 81.
[0033] The gate valve 84 which can switch the switching condition of a path 69 is arranged about the

path 69 currently formed between the vacuum chamber 2 and the supplement tub 61. In order to carry out switching operation of the gate valve 84, the output shaft 86 of the actuation means 85, such as an actuator formed in the exterior of the supplement tub 61, penetrated bottom wall 61a of the supplement tub 61 in the seal condition, and is prolonged inside [62] the supplement tub 61, and the bulb 88 is formed in the point of an output shaft 86 through the neighborhood link mechanism 87. If an output shaft 86 goes up and a bulb 88 runs against stopper 69b with a rise of an output shaft 86 by actuation of the actuation means 85, a bulb 88 will be pressed against perimeter [opening] 69a (drawing 5 R> 5) of a path 69 through the neighborhood link mechanism 87 until the output shaft 86 which goes up further runs against stopper 69b (drawing 4). O ring 89 (drawing 5) is formed in the sealing surface of a bulb 88, and when breaking the vacuum inside [62] the supplement tub 61, he is trying for there to be no effect in the vacuum in the vacuum chamber 2.

[0034] If the evaporation cel supplement device 60 is applied to the organic EL device manufacturing installation 1, the gate valve 84 prepared between the supplement tubs 61 attached in the vacuum chamber 2 and the vacuum chamber 2 will be closed, and the closing motion door 80 prepared in the supplement tub 61 where a path 69 is closed will be opened. The conveyance base 63 which can lay the evaporation cel 4 in the supplement tub 61 is held, and the evaporation cel 4 for a supplement is laid in the conveyance base 63. When the conveyance base 63 is already held in the supplement tub 61, the evaporation cel 4 can be immediately laid in the conveyance base 63 from the open closing motion door 80. Then, the closing motion door 80 is closed and the supplement tub 61 is sealed. The supplement tub 61 is made into the sealing condition also to the vacuum chamber 2, and re-vacuation is [independently] possible for the interior 62. After the interior 62 of the supplement tub 61 has become a vacuum, a gate valve 84 is opened. since a gate valve 84 permits passage of the conveyance base 63 in the state of open -- the conveyance base 63 -- actuation of a drive 70 -- from the return location in the supplement tub 61 -- since -- it is conveyed in the advance location in the vacuum chamber 2.

[0035] The conveyance base 63 of each other is ****(ed) to the horizontal direction which is the conveyance direction, and can lay the evaporation cel 4 of two or more trains in it. In this example, since two evaporation cels 4 and 4 are used for coincidence within the vacuum chamber 2, the stop section 90 is formed in the shape of [of 2x3] a grid 3 times so that it may be exchangeable. As shown in drawing 6 , fitting especially of the stop section 90 is carried out to the wearing hole 91 currently formed in the conveyance base 63 corresponding to the grid, and it is prepared as an adapter which engages with the evaporation cel 4 and is positioned. Where fitting of the stop section 90 is carried out to the wearing hole 91, the through tube 92 of the length along which the bearing bar 36 of the evaporation cel 4 passes is formed in the core, and the engagement section 21 currently formed in the point of the climbing-shaft object 20 gone up and down to the perpendicular direction of a driving means 5 can insert a through tube 92 in a rectangular condition with the rod.

[0036] A drive 70 is used also in order to make the conveyance base 63 convey, whenever exchange of the evaporation cel 4 is performed. In this case, the advance location of the conveyance base 63 is set as two or more locations where the evaporation cel 4 responded to being conveyed to the location which engages or breaks away [engagement] with the engagement section 21 of a driving means 5 for every train. By conveyance by the drive 70, a sequential halt of the conveyance base 63 is carried out in two or more advance locations beforehand set up within the vacuum chamber 2, and the evaporation cels 4 and 4 of two or more trains laid on the conveyance base 63 are moved one after another to the location which engages or breaks away [engagement] with the engagement section 21 of a driving means 5. When conveying the conveyance base 63 toward the inside of the vacuum chamber 2 with a drive 70, migration in the exchange location of the evaporation cel 4 can be correctly controlled by detecting the advance location of the conveyance base 63 by the sensor. By ****(ing) in the conveyance direction and laying the evaporation cels 4 and 4 of two or more trains in the conveyance base 63, thus, at the time of exchange of the evaporation cel 4 After the used evaporation cel 4 is received by the stop section 90 on the conveyance base 63 in the condition that residual installation is carried out, the advance location 4 and 4 of a degree, i.e., the evaporation cels of the following train, moves [drive / 70] the conveyance base 63 until it arrives at the exchange location which the engagement section 21 of the driving means 5

in the vacuum chamber 2 goes up and down. In the supplement tub 61, it is exchange (a supplement and exchange of six evaporation cels 4) with one supplement of the evaporation cel 4 on the conveyance base 63, or the used evaporation cel 4, and it is possible in the organic EL device manufacturing installation 1 only for the number of the trains laid in the conveyance base 63 to use the evaporation cel 4 over multiple times (3 times), carrying out sequential exchange.

[0037] The receptacle section 95 which supports the point of the conveyance base 63 conveyed in the vacuum chamber 2 is arranged by the vacuum chamber 2. The receptacle section 95 was formed on the production of the same height as the support roller 66 of the supplement tub 61, and is equipped with the receptacle roller 96 which supports the inferior surface of tongue of the conveyance base 63. The receptacle roller 96 can support the conveyance base 63 by low friction. Since a point receives the conveyance base 63 and it is supported in the section 95 when it marches out in the vacuum chamber 2 from the supplement tub 61, it does not have un-arranging [of inclining with a self-weight], and can maintain the conveyance base 63 at a horizontal position.

[0038] The location of the through tube 92 of the stop section 90 by which the conveyance base 63 conveyed by the drive 70 of the evaporation cel supplement device 60 is established in the conveyance base 63 in the location occupied within the vacuum chamber 2 is in agreement with the rise-and-fall location of the engagement section 21 of a driving means 5. The engagement section 21 which goes up by actuation to a driving means 5 engages with the evaporation cel 4, the through tube 92 of the stop section 90 is passed, and the evaporation cel 4 goes up further and is carried to the rise location U by the engagement section 21. It is as having already explained cooling of heating of the evaporation cel 4 by the heating means 6 in the rise location U, and the evaporation cel 4 in the mid-position M. When the organic raw material has evaporated, a driving means 5 drops the evaporation cel 4 from the mid-position M to the downward exchange location F further, and makes the used evaporation cel 4 lay in the condition of having engaged with the stop section 90 on the conveyance base 63. Since a driving means 5 still enables evasion of interference with the conveyance base 63, it can drop the engagement section 21 from the exchange location F to the downward downward location L. What is necessary is to move the conveyance base 63 in the conveyance direction to the advance location of the following **, and just to move the new evaporation cel 4 to the rise-and-fall location of the engagement section 21, when exchanging the evaporation cel 4.

[0039]

[Effect of the Invention] According to the manufacturing installation of the organic EL device by this invention, while being attached in a vacuum chamber, the interior can be vacuated and the exterior and a vacuum chamber are received. The supplement tub which can be closed in the seal condition, respectively, The conveyance base which has the installation section which lays the evaporation cel for a supplement in a positioning condition while being able to hold in the supplement tub, It has the drive which conveys the conveyance base possible [a round trip] between the loading location in a supplement tub, and the advance location in a vacuum chamber. The engagement section makes descent possible to the downward location of the lower part of the conveyance base conveyed by the driving means in the advance location. Since it carried out as the configuration by which an evaporation cel engages with the engagement section which carries out rise passage of the conveyance base, is raised from the installation section, carries out engagement balking from the engagement section which carries out downward passage of the conveyance base, and residual installation is carried out at the installation section Operation of an organic EL device manufacturing installation is not stopped, and the supplement of the evaporation cel from the outside can be performed, having not canceled the vacuum of a vacuum chamber, either and maintaining it. It is not necessary to vacuate a vacuum chamber again after a supplement and exchange of an evaporation cel, and the operation effectiveness of an organic EL device manufacturing installation can be raised. Moreover, since the device to which the evaporation cel after a supplement is moved to a heating location consists of the simplified structure of having the conveyance base conveyed horizontally and the driving means which operates perpendicularly to a conveyance base, it is an easy device to a heating location, and the evaporation cel after a supplement can be moved promptly. Consequently, since the restart of evaporation of an organic raw material is attained at an

early stage while the manufacture cost of an organic EL device manufacturing installation decreases and operation effectiveness improves, the organic EL device manufacturing installation which reduced the manufacturing cost of an organic EL device can be offered. Moreover, according to this organic EL device manufacturing installation, by one supplement of an evaporation cel, the evaporation cel of multiple times can be exchanged, and operation of a manufacturing installation is suspended, the vacuum of a vacuum chamber can be canceled, or the need of vacuating a vacuum chamber again on the occasion of resumption of operation can also be abolished, the operation effectiveness of a manufacturing installation improves further, and the manufacturing cost of an organic EL device can decrease further, and can also manufacture an organic EL device still more cheaply in the meantime.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号
特開2003－115379
（P2003－115379A）
(43)公開日　平成15年４月18日(2003.4.18)

(51)Int.Cl.⁷	識別記号	ＦＩ		ﾃｰﾏｺｰﾄﾞ(参考)
Ｈ０５Ｂ　33/10		Ｈ０５Ｂ	33/10	３Ｋ００７
Ｃ２３Ｃ　14/12		Ｃ２３Ｃ	14/12	４Ｋ０２９
14/24			14/24	Ｄ　５Ｇ４３５
Ｇ０９Ｆ　9/00	３４２	Ｇ０９Ｆ	9/00	３４２Ｚ
Ｈ０５Ｂ　33/14		Ｈ０５Ｂ	33/14	Ａ

審査請求　未請求　請求項の数７　ＯＬ　（全 10 頁）

(21)出願番号　特願2001－298706(P2001－298706)

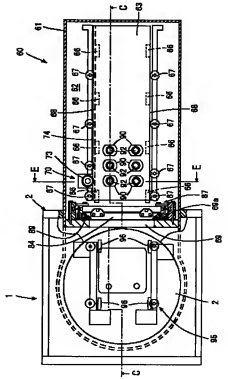
(22)出願日　平成13年９月28日(2001.9.28)

(71)出願人　501284055
磯光顯示科技股▲分▼有限公司
台湾新竹市埔頂路18號６樓之一
(72)発明者　陳　華夫
台湾新竹市埔頂路18號６樓之一
(74)代理人　100108567
弁理士　加藤　雅夫

Ｆターム(参考)　３Ｋ００７　ＡＢ１８　ＤＢ０３　ＥＢ００　ＦＡ０１
４Ｋ０２９　ＢＡ６２　ＢＣ０７　ＢＤ００　ＢＤ０１　ＣＡ０１
ＤＢ０６　ＤＢ１３　ＤＢ１５
５Ｇ４３５　ＡＡ１７　ＢＢ０５　ＨＨ０１　ＨＨ２０　ＫＫ０５
ＫＫ１０

(54)【発明の名称】　有機ＥＬ素子製造装置

(57)【要約】
【課題】　装置の運転を停止することなく真空チャンバの真空を維持したまま蒸発セルの補充を行うことにより、製造装置の運転効率を向上し、有機ＥＬ素子の製造コストを低減可能な有機ＥＬ素子製造装置の蒸発セル補充装置を提供する。
【解決手段】　蒸発セル４は、補充槽６１に収容された搬送台６３に搭載される。補充槽６１は、外部及び真空チャンバ２に対して気密に遮断され再真空化可能となる。ゲートバルブ８４を開けて補充槽６１と真空チャンバ２との間の通路６９が開通されると、搬送台６３はラック７４とピニオン７３とを有する駆動機構７０の作動によって補充槽６１内の装填位置からから真空チャンバ２内の進出位置へと水平搬送される。縦方向に動作する駆動手段５の係合部２１が、搬送台６３に搭載された蒸発セル４に係合して、加熱位置や冷却位置に移動可能である。



【特許請求の範囲】

【請求項１】　有機原料が収容されている蒸発セルと離脱可能に係合する係合部を有し且つ前記蒸発セルを上昇位置まで昇降させる駆動手段、及び前記有機原料を蒸発させるため前記上昇位置を占めている前記蒸発セルを加熱する加熱手段を備え、前記蒸発セルから蒸発した前記有機原料の基板への蒸着が真空チャンバの内部で行われる有機ＥＬ素子製造装置において、前記真空チャンバに取り付けられると共に内部が真空化可能であり且つ外部及び前記真空チャンバに対してそれぞれ密封状態に閉鎖可能な補充槽、前記補充槽に収容可能であると共に補充用の前記蒸発セルを位置決め状態に載置する載置部を有する搬送台、及び前記搬送台を前記補充槽内の装填位置と前記真空チャンバ内の進出位置との間で往復可能に搬送する駆動機構を備え、前記駆動手段は前記係合部を前記進出位置に搬送された前記搬送台の下方の下降位置まで下降可能であり、前記蒸発セルは、前記搬送台を上昇通過する前記係合部と係合して前記載置部から持ち上げられ、前記搬送台を下降通過する前記係合部から係合離脱して前記載置部に残留載置されることから成る有機ＥＬ素子製造装置。

【請求項２】　前記補充槽には外部から前記補充槽への前記蒸発セルの出し入れを許容する密封可能な開閉扉が設けられ、前記真空チャンバと前記補充槽との間には前記搬送台の通過を許容する開状態と密閉遮断する閉状態との間で切換え可能なゲートバルブが設けられていることから成る請求項１に記載の有機ＥＬ素子製造装置。

【請求項３】　前記搬送台は搬送方向に隔置して複数列の前記蒸発セルを載置可能であり、前記搬送台の前記進出位置は、前記蒸発セルが前記各列毎に前記駆動手段の前記係合部と係合又は係合離脱する位置まで搬送されることに対応した複数位置に設定されていることから成る請求項１又は２に記載の有機ＥＬ素子製造装置。

【請求項４】　前記搬送台は回転自在な複数のローラによって支持されており、前記駆動機構は、前記搬送台の側部に形成されているラック、前記補充槽に回転自在に支持され前記ラックに噛み合うピニオン、及び前記ピニオンを駆動する駆動モータを備えていることから成る請求項１～３のいずれか１項に記載の有機ＥＬ素子製造装置。

【請求項５】　前記真空チャンバには、前記真空チャンバ内に搬送された前記搬送台の先端部を支持する受け部が配設されていることから成る請求項１～４のいずれか１項に記載の有機ＥＬ素子製造装置。

【請求項６】　前記蒸発セルは内部に前記有機原料を収容し且つ前記駆動手段の前記係合部が係合可能な底部を有する筒状容器から成り、前記搬送台の前記載置部には、前記蒸発セルの通過は許容しないが前記駆動手段の前記係合部が通過可能な貫通孔が形成されていることから成る請求項１～５のいずれか１項に記載の有機ＥＬ素子製造装置。

【請求項７】　前記上昇位置と前記搬送台が搬送された前記進出位置との間の上下方向中間位置において、前記蒸発セルを冷却するセル冷却手段が設けられていることから成る請求項１～６のいずれか１項に記載の有機ＥＬ素子製造装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、蒸発セルを加熱して生じさせた有機原料の蒸発ガスを基板上に付着させる蒸着法によって基板上に有機薄膜を形成する有機ＥＬ素子製造装置において、有機ＥＬ素子製造装置が稼働中であっても、蒸発セルの補充を可能にした有機ＥＬ素子製造装置に関する。

【０００２】

【従来の技術】有機ＥＬ（エレクトロルミネセンス）ディスプレイのような有機ＥＬ素子は、薄型で全固体型の面発光表示デバイスであり、バックライトが不要で消費電力が少なく、信頼性が高く、高精細、高コントラストの高画質表示が可能であることから、近年、ディスプレイの分野で着目されている。有機ＥＬ素子は、金属材料を蒸着することにより完成時に陽極となる透明電極と、その透明電極上に形成された発光層となる有機ＥＬ素子の有機薄膜と、その有機薄膜の上にプリント配線基板等の基板上に完成時に陰極となる金属電極とを備えている。このような有機ＥＬ素子は、例えば、真空蒸着法又はスパッタリング法で金属電極と透明電極とを形成し、真空蒸着法で有機薄膜を形成することで製造されている。

【０００３】有機薄膜の真空蒸着は、具体的には、内部に蒸着材料である有機原料を収容した蒸発源を真空槽内で加熱して有機材料を蒸発させ、蒸発したガス状の有機原料を蒸発源の上方に配置した基板の下向きの被蒸着面に付着させて成膜させることで行われている。蒸発源は、有機原料を収容した、例えば、セラミック、透明ガラス等、適宜の材料から形成される坩堝のような容器から形成された蒸発セルとすることができる。蒸発セルの直上又は基板の直下の位置には、蒸着を制御するための可動シャッタが設けられている。蒸着の初期には、可動シャッタを閉状態として不純物を含んだ蒸発物が基板に付着するのを防止し、原料の蒸発速度が一定となった一定時間経過後に可動シャッタを開いて、蒸着速度の制御が安定した状態で基板の被蒸着面への成膜が行われている。成膜の都度、基板の上に所定のマスクを配置した状態で蒸着を行うことにより、有機薄膜が所定のパターンで成形される。

【０００４】有機原料を間接的に加熱してガス化する一つの方法として、原料容器を坩堝で形成しその周囲にヒータを設け、このヒータに通電することで坩堝を加熱する方法がある。また、抵抗加熱蒸着法として、融点の高

いタングステン、タンタル、モリブデン等の金属材料を薄板状に加工して、電気抵抗を高くした金属板から原料容器を製作し、その原料容器に直流電流を流して発熱させることで、有機原料を蒸発させる方法もある。この方法は、製造装置の構造が簡単で且つ安価となるので、真空蒸着法の中で普及している。有機原料を間接的に加熱する方法以外の方法として、原料に直接に電子ビームやレーザービームを照射し、そのエネルギーで原料を蒸発させる電子ビーム・レーザービーム蒸着法がある。

【０００５】従来、蒸発セルに含まれる有機原料を蒸発し切った場合には、真空チャンバ内の所定位置に配置されていた蒸発セルの容器を回収して、新たな有機原料が収容された蒸発セルを上記所定位置に装填することによって、蒸発セルの補充・交換が行われている。新たな蒸発セルは有機ＥＬ素子製造装置の外部に置かれているので、蒸発セルの補充・交換に際しては、真空チャンバ内の真空を一旦解除し、蒸発セルの補充・交換を行った後、再度真空チャンバ内を真空化している。この作業のうち、特に真空チャンバの再真空化は、時間を要し、有機ＥＬ素子製造装置の効率的な稼働を妨げている。

【０００６】有機材料が非常に高価であるため、有機ＥＬ素子を安価に供給するには、有機ＥＬ素子の製造コストを低減することが肝要であり、特に、製造装置を連続して運転し、製造装置の一度の連続運転中にできるだけ多くの有機ＥＬ素子を製造することが必要である。即ち、有機原料の蒸発は高度に真空状態とされた製造装置のチャンバ内で行われるので、有機原料の補充や交換を行うために頻繁に製造装置を停止すると、その度、真空チャンバの真空解除と再真空化が必要となって装置の稼働効率が悪化し、製品コストが上昇する。従って、一度に比較的多量の原料量を収容することが可能なセル型蒸発源を用いた場合であっても、一度真空にされた製造装置の真空槽で連続して基板に対して蒸着を行うことが好ましい。

【０００７】ゲートバルブで真空室と遮断可能に分離された収容室内に、有機材料が充填された複数のルツボを用意し、これらルツボのいずれか一つを選択し、ハンドとアームとを有する搬送ロボット機構でそのルツボを真空室内の蒸発源（加熱源）に取り付けた有機薄膜形成装置の一例が、特開２０００－２２３２６９号公報に開示されている。搬送ロボット機構は、構造が複雑であり、また、真空室内にヘルツボの搬送は一度に１個に限られる。蒸発源も高さ位置を変えられないので、蒸発源の冷却等に対応する柔軟性が期待できない。

【０００８】

【発明が解決しようとする課題】上記のように、有機ＥＬ素子の製造に関して、蒸発セルの補充の度に、製造装置の運転を停止し真空チャンバの真空を解除するのでは、蒸発セルの交換・補充の後に真空チャンバを再度真空化する必要があり、製造装置の運転効率が向上せず、有機ＥＬ素子の製造コストを低減させることができない。また、補充後の蒸発セルを加熱位置まで移動させる機構が複雑であると、製造装置の製作コストが上昇するとともに運転効率も向上せず、結果的に、有機ＥＬ素子の製造コストを更に上昇させる。従って、有機ＥＬ素子の製造装置の運転を停止させず、真空チャンバの真空を維持したまま、外部から蒸発セルを真空チャンバ内に供給を可能にして蒸発セルの補充を行い、補充後の蒸発セルを加熱位置まで簡単な機構で且つ速やかに移動させる点で解決すべき課題がある。

【０００９】この発明の目的は、有機ＥＬ素子の製造に関して、製造装置の運転を停止することなく真空チャンバの真空を維持したまま、外部から蒸発セルを真空チャンバ内に供給して蒸発セルの補充を行い、補充後に蒸発セルを速やかに加熱位置にまで移動させることにより、製造装置の運転効率を向上する共に有機原料の蒸発を早期に再開可能にして、有機ＥＬ素子を安価に製造することを可能にする有機ＥＬ素子製造装置を提供することである。

【００１０】

【課題を解決するための手段】上記の課題を解決するため、この発明による有機ＥＬ素子製造装置は、有機原料が収容されている蒸発セルと離脱可能に係合する係合部を有し且つ前記蒸発セルを上昇位置まで昇降させる駆動手段、及び前記有機原料を蒸発させるため前記上昇位置を占めている前記蒸発セルを加熱する加熱手段を備え、前記蒸発セルから蒸発した前記有機原料の基板への蒸着が真空チャンバの内部で行われる有機ＥＬ素子製造装置において、前記真空チャンバに取り付けられると共に内部が真空化可能であり且つ外部及び前記真空チャンバに対してそれぞれ密封状態に閉鎖可能な補充槽、前記補充槽に収容可能であると共に補充用の前記蒸発セルを位置決め状態に載置する載置部を有する搬送台、及び前記搬送台を前記補充槽内の装填位置と前記真空チャンバ内の進出位置との間で往復可能に搬送する駆動機構を備え、前記駆動手段は前記係合部を前記進出位置に搬送された前記搬送台の下方の下降位置まで下降可能であり、前記蒸発セルは、前記搬送台を上昇通過する前記係合部と係合して前記載置部から持ち上げられ、前記搬送台を下降通過する前記係合部から係合離脱して前記載置部に残留載置されることから成っている。

【００１１】このように構成された有機ＥＬ素子製造装置によれば、駆動手段に作動によって上昇する係合部は蒸発セルと係合して係止部を通過可能であり、蒸発セルは係合部によって更に上昇して上昇位置に運ばれる。上昇位置において加熱手段によって加熱されることで蒸発セルから蒸発したガス状の有機原料は、真空チャンバの上側に配置されている基板の下側面に付着することで蒸着される。加熱手段による蒸発セルの加熱は急速に行われるので、有機原料は無駄になる量が少なく効率的に使

用される。蒸発セルの有機原料が蒸発し切ると、駆動手段は蒸発セルを搬送台の下降位置まで下降させ、搬送台を下降通過するときに、使用済みの蒸発セルを搬送台上の載置部に残して載置させる。蒸発セルを有機ＥＬ素子製造装置に補充するときには、真空チャンバとの間を密封状態として外部から補充槽に蒸発セルが供給され、補充槽が真空化され、次に外部との間を密封状態として補充槽と真空チャンバとの間が開通される。蒸発セルを交換するときには、搬送台が真空チャンバ内に進出され、新しい蒸発セルが駆動手段の係合部に係合し、駆動手段によってその状態で上昇される。詳細には、蒸発セルの補充槽への供給に際しては、蒸発セルは補充槽に収容された搬送台に載置される。搬送台が既に補充槽に収容されている場合には、蒸発セルは直ちに搬送台に載置される。補充槽は、外部及び真空チャンバに対して気密に遮断されるので、内部は再真空化可能となる。補充槽と真空チャンバとの間が開通されると、搬送台の通過が可能となり、搬送台は駆動機構の作動によって補充槽内の装填位置からから真空チャンバ内の進出位置へと搬送される。駆動機構によって搬送台を真空チャンバ内に向かって搬送するとき、搬送台の進出位置を制御することにより、有機ＥＬ素子製造装置内で占める位置は正確に制御可能となり、搬送台に位置決め状態に載置されている蒸発セルは、交換のために搬送台上の載置部から駆動手段の係合部へと受け渡される。

【００１２】この有機ＥＬ素子製造装置において、前記補充槽には外部から前記補充槽への前記蒸発セルの出し入れを許容する密封可能な開閉扉が設けられ、前記真空チャンバと前記補充槽との間には前記搬送台の通過を許容する開状態と密閉遮断する閉状態との間で切換え可能なゲートバルブが設けられている。外部と補充層との間に設けられる開閉扉は、蒸発セルの補充層への供給時に開かれ、そのとき、真空チャンバ内の真空を維持するためにゲートバルブは閉じられている。真空チャンバと補充槽との間に設けられているゲートバルブは、開閉扉を閉じて密封状態とされた補充槽が真空状態になっているときにのみ開かれる。搬送台は、開状態となっているゲートバルブを通して、駆動機構の作動によって補充槽内の装填位置からから真空チャンバ内の進出位置へと搬送される。

【００１３】この有機ＥＬ素子製造装置において、前記搬送台は搬送方向に隔置して複数列の前記蒸発セルを載置可能であり、前記搬送台の前記進出位置は、前記蒸発セルが前記各列毎に前記駆動手段の前記係合部と係合又は係合離脱する位置まで搬送されることに対応した複数位置として設定されている。搬送台に搬送方向に隔置して複数列の蒸発セルを載置することにより、搬送台による補充槽への蒸発セルの１回の補充で、有機ＥＬ素子製造装置では搬送台に載置された列の数だけ複数回に渡って蒸発セルを順次交換して使用することが可能である。蒸発セルの交換は、その交換時に、真空チャンバ内での搬送台を駆動機構の搬送で送り、予め設定された複数の進出位置に順次停止させる。このとき、搬送台に載置された複数列の蒸発セルは、駆動手段の係合部と係合又は係合離脱する位置まで次々に移動される。

【００１４】この有機ＥＬ素子製造装置において、前記搬送台は回転自在な複数のローラによって支持されており、前記駆動機構は、前記搬送台の側部に形成されているラック、前記補充槽に回転自在に支持され前記ラックに噛み合うピニオン、及び前記ピニオンを駆動する駆動モータを備えている。搬送台は回転自在な複数のローラによって支持されているので、搬送台が搬送されるとき、搬送台の走行抵抗は可及的に小さいものとなる。また、駆動機構は、回転を往復動に変換する構成として、駆動モータの駆動力が伝達されるピニオンとこのピニオンが噛み合う搬送台の側部に形成されているラックとを有することにより、駆動機構の構造が機構的に簡素であり且つ作動が確実となる。

【００１５】この有機ＥＬ素子製造装置において、前記真空チャンバには、前記真空チャンバ内に搬送された前記搬送台の先端部を支持する受け部を配設するのが好ましい。搬送台は、補充槽から真空チャンバ内に進出したときに、先端部が受け部で支持されるので、自重によって傾斜する等の不都合がない。受け部では、低摩擦にて支持するため搬送台の下面をローラで支持することが好ましい。

【００１６】この有機ＥＬ素子製造装置において、前記蒸発セルについては内部に前記有機原料を収容し且つ前記駆動手段の前記係合部が係合可能な底部を有する簡状容器から構成し、前記搬送台の前記載置部には、前記蒸発セルの通過は許容しないが前記駆動手段の前記係合部が通過可能な貫通孔を形成することが好ましい。蒸発セル補充用の駆動機構によって搬送された搬送台が真空チャンバ内で占めることになる進出位置では、搬送台に設けられている載置部の貫通孔の位置が駆動手段の先端部に設けられる取付け部の昇降位置と一致する。また、搬送台の搬送方向を水平方向とし、駆動手段の係合部の垂直方向の昇降方向と直交交差させるのが、搬送台の位置割り出しを行ったり搬送台の載置部に載置された蒸発セルに対して駆動手段の係合部を係合させる上で好ましい。

【００１７】この有機ＥＬ素子製造装置において、前記上昇位置と前記搬送台が搬送された前記進出位置との間の上下方向中間位置において、前記蒸発セルを冷却するセル冷却手段を設けることができる。基板への有機原料の蒸着が終了すると、加熱手段による蒸発セルの加熱が停止され、蒸発セルは駆動手段によって中間位置まで下降されてセル冷却手段によって冷却される。蒸発セルの温度は急速に低下し、蒸発セルからの有機原料の蒸発が急速に停止する。蒸発セルの加熱と冷却とがそれぞれ蒸

発セルが占める異なる位置で行われるが、蒸発セルのこれらの各位置間における移動は、駆動手段の単純な昇降動作によってスムーズで且つ素早く行われ、また加熱手段とセル冷却手段とは互いに干渉することもないので、有機ＥＬ素子製造装置の構造が簡単となり且つ運転効率が向上する。また、冷却手段による蒸発セルの冷却は急速に行われるので、有機原料は無駄になる量が少なく効率的に使用される。

【００１８】

【発明の実施の形態】以下、添付図面を参照しつつ、この発明による有機ＥＬ素子製造装置の実施例を説明する。図１はこの発明による有機ＥＬ素子製造装置の一実施例を示す縦断面図、図２は有機ＥＬ素子製造装置に用いられる冷却手段の一例を示す縦断面図であって図３のＡ－Ａ断面図、図３は図２に示す冷却手段の平面Ｂ－Ｂで切断した平面図、図４は図１に示す有機ＥＬ素子製造装置の蒸発セル補充機構を示す縦断面図であって図５のＣ－Ｃ断面図、図５は図４に示す蒸発セル補充機構の平面Ｄ－Ｄで切断した断面図、図６は図４に示す蒸発セル補充機構の平面Ｅ－Ｅで切断した断面図である。

【００１９】図１に示す有機ＥＬ素子の製造装置１は、装置フレームに支持された真空チャンバ２と、真空チャンバ２内に縦置き状態に配置され且つ上端に成膜すべき基板８が配置される蒸発筒３と、基板８に蒸着させるべき有機原料９（図２、図３参照）を収容可能な筒状容器を持ち且つ蒸発筒３内の上昇位置Ｕ、搬送台（後述する）の下方の下降位置Ｌ、及び上昇位置Ｕと下降位置Ｌとの間に位置し且つ蒸発筒３外の中間位置Ｍの間で上下動可能な蒸発セル４と、蒸発セル４を上下動させる駆動手段５と、蒸発セル４内に収容されている有機原料９を蒸発させるため上昇位置Ｕを占めている蒸発セル４を加熱する加熱手段６と、中間位置Ｍを占めている蒸発セル４を冷却するセル冷却手段７とを備えている。

【００２０】真空チャンバ２は、適宜の形状を有しており、装置フレーム１０によって床台上に設置されている。真空チャンバ２の内部１１は、図示しない真空引き手段（クライオポンプ）によって、通常は高度な真空状態に維持されている。真空チャンバ２には、図示しないが、適宜の位置に、内部１１を覗くことが可能な耐圧ガラス窓を設けることができる。真空チャンバ２の内部１１には、蒸発筒３が支持脚１２によって支持された状態で設置されている。蒸発筒３は、銅のような熱伝導度の高い金属から成る縦置きされた角筒体、円筒体等の筒体で構成されており、上端と下端とはそれぞれ開口２５ａ，２５ｂとなっている。蒸発筒３は、蒸発セル４が蒸発させた有機原料ガス（以下、「蒸発ガス」という）を基板８に向かって上昇するのを案内する働きをしている。図示の例では、真空チャンバ２内には、一つの蒸発筒３のみが収容されているが、複数の蒸発筒３を並べて収容してもよい。この場合、各蒸発筒３において、上記の蒸発セルや駆動手段５、セル冷却手段７、及び後述する蒸発セル補充装置が配設されるが、各蒸発セル４内に収容される有機原料９は基板８に蒸着する順に異種類の原料とすることができる。

【００２１】蒸発セル４は、特に、外部から有機原料の残量を視認するとともに、上端が開口した透明なガラス製の坩堝とすることが好ましい。加熱手段６は蒸発筒３内に取り付けられており、蒸発セル４が駆動手段５によって蒸発筒３内の上昇位置Ｕにまで上昇したとき、蒸発セル４は加熱手段６に取り付けられることはないが囲まれた状態となる。加熱手段６は、真空チャンバ２の外部から延びる電線（図示せず）を通じて電源が供給される抵抗加熱線を備えた筒状ヒータの形状を有する間接的な加熱手段であり、蒸発セル４内に収容されている有機原料９を蒸発させるため、蒸発セル４を周囲から例えば２００℃～３００℃にまで加熱する。

【００２２】駆動手段５は、モータ１５と、モータ１５の回転出力を伝達するベルト伝動機構１６と、ベルト伝動機構１６の出力側の回転を伝える継ぎ手１７と、継ぎ手１７によって回転されるねじ軸１８と、ねじ軸１８に螺合するボールナット１９と、ボールナット１９に取り付けられている昇降筒体２０と、昇降筒体２０の先端に形成されており蒸発セル４と係合可能な係合部２１とを有している。駆動手段５は、また、継ぎ手１７から係合部２１までの構造を密封状態に取り囲んで真空チャンバ２の内部１１の真空を保つケース２２を有している。更に、昇降筒体２０には縦方向に延びる一対のスリット２３が形成されており、真空チャンバ２に取り付けられている規制駒２４がスリット２３に係合している。従って、モータ１５の回転はベルト伝動機構１６と継ぎ手１７とを介してねじ軸１８に伝達され、昇降筒体２０は、ねじ軸１８と規制駒２４によって回転規制されているボールナット１９とのねじ作用とによって昇降駆動される。昇降筒体２０の昇降は、モータ１５の回転方向に応じて定まる。図示した駆動手段５は、一例であり、エアシリンダ等から成るアクチュエータを採用することができることは、言うまでもない。

【００２３】蒸発筒３の上側の開口２５ａの上方には、開口２５ａに近接して開閉可能なシャッタ２６が配置されている。真空チャンバ２に接続されているシャッタ進退通路２７の後方には、シャッタ２６の開閉作動用として、例えば駆動機構５と同様の機構を設けることができ、かかる機構を作動させることにより、シャッタ２６をシャッタ進退通路２７で進退させてシャッタ２６の開閉作動を行うことができる。シャッタ２６は、蒸着期間以外において閉じることで、蒸発ガスが蒸発筒３から基板８に向かって更に上昇して付着するのを阻止している。基板８の直下にもシャッタ（図示せず）を設けることにより、不純物を含む可能性が高い蒸発開始当初の蒸発ガスによる基板８への蒸着を更に防止するようにして

もよい。

【００２４】真空チャンバ２の上壁部２ａには、シャッタ２６の直上において、基板ホルダ２８が取り付けられており、搬送手段３０によって搬送されてきた基板８は、蒸発筒３の真上の位置において、基板ホルダ２８と、基板ホルダ２８と共同する保持具２９とによって挟まれることで保持される。基板ホルダ２８の直ぐ下方には、所定のパターンを有するマスク３１をマスクホルダ３２によって保持可能であり、マスク３１のパターンに応じた基板８の露出部分にのみ有機材料を蒸着させることができる。保持具２９及びマスクホルダ３２の作動は、真空チャンバ２の上壁部２ａを密封状態に貫通する操作軸３３，３４によって行うことができる。

【００２５】図２及び図３に示すように、セル冷却手段７は、中間位置Ｍを占める蒸発セル４に対して、その側方から接近可能なセル冷却体４０，４０を備えている。セル冷却体４０，４０は、接近状態で蒸発セル４から速やかに熱を奪うことができるように、例えば、熱伝導度が高い銅製のケースとすることが好ましい。蒸発セル４の下端には、駆動手段５の支持部２１に形成されている支持穴３５に嵌入係合する支持棒３６が突出して取り付けられている。各セル冷却体４０は、蒸発セル４に面する側に蒸発セル４の外筒面３７の半分を取り囲む半筒状の湾曲面４１と、下側部において、蒸発セル４の底面３８に対応した扇形状の棚面４３を有する棚部４２とを備えている。各セル冷却体４０は、棚部４２の棚面４３が蒸発セル４の底面３８と載せることによって、蒸発セル４を安定して保持し且つ蒸発セル４を底面３８から冷却することができる。

【００２６】冷却媒体としての摂氏３度～４度の冷却水は、真空チャンバ２の外部に配設されている熱交換機５０（図１参照）から冷却導管としての供給管４５を通って各セル冷却体４０の内部に形成されている冷却室４４に流入し、戻り管４６を通って熱交換機５０に戻る。図１に示すように、供給管４５と戻り管４６とは、真空チャンバ２の周壁部２ｂを密封状態に貫通しており、真空チャンバ２の外側に配設されている作動機構としてのエアアクチュエータ４７，４７（一方のみ図示）にまで延びた連結部を兼ねており、エアアクチュエータ４７，４７によって駆動されて、各セル冷却体４０を蒸発セル４に対して進退させることができる。

【００２７】基板８への有機原料の蒸着を停止させるときには、加熱手段６への通電を停止すると共に蒸発セル４を駆動手段５によって中間位置Ｍまで下降させ、作動機構としてのエアアクチュエータ４７，４７を作動させて、セル冷却体４０，４０を蒸発セル４に対して進出させる。蒸発セル４に近接したセル冷却体４０，４０は、蒸発セル４から熱を奪うことで冷却を開始し、有機原料の蒸発を直ちに停止させる。その結果、高価な有機原料の蒸発が止まり、基板８に蒸着されることなく拡散していた有機原料の無駄な消費を抑えて有機原料を効率的に使用することが可能となり、有機ＥＬ素子の製造コストを低減させることができる。

【００２８】蒸発ガスは、シャッタ２６を開けることで基板８に向かって流れ出る。蒸発筒３内に止まっている蒸発ガス及び蒸発筒３の下側の開口２５ｂから真空チャンバ２内に拡散しようとする蒸発ガスについては、蒸発筒３を冷却することにより、蒸発筒３の内面３ａに直接に昇華させることで回収が図られる。即ち、蒸発筒３を冷却するため、この発明による冷却手段５４が蒸発筒３に関連して設けられている。図１に示すように、冷却手段５４は、蒸発筒３の下端部３ｂに沿った環状形状を有し下端部３ｂに取り付けられている冷却部５５と、冷却部５５と真空チャンバ２の外部に配設されている熱交換機５０との間で冷却媒体を循環させるため、冷却部５５に接続された冷却導管５６，５７とを備えている。冷却媒体は、セル冷却手段７の場合と同様に、摂氏３度～４度の冷却水とすることができる。冷却導管５６，５７は、真空チャンバ２の周壁部２ｂを密封状態に貫通して設けられている。蒸発筒３を冷却することで、蒸発筒３内の蒸発ガスは、蒸発筒３の内面３ａに直接に昇華させられて付着する。製造装置１の保守点検等の適宜時期に真空チャンバ２から蒸発筒３を取り出し、昇華した固形の有機原料を内面３ａから削り取ることで、有機原料を回収して再利用に供することができる。

【００２９】図４～図６に示すように、有機ＥＬ素子製造装置１における蒸発セル補充機構６０は、真空チャンバ２の下側の側部に取り付けられる補充槽６１を備えており、補充槽６１は、その内部６２に、補充用の蒸発セル４を位置決め状態に載置可能な搬送台６３を収容可能なスペースを有している。真空チャンバ２との接続時に真空チャンバ２内の真空を維持するため、補充槽６１の内部６２は、補充槽６１の底壁６１ａに取り付けられている吸引管６４（図４）を通じて真空化可能である。補充槽６１の真空化には、真空チャンバ２を真空化するための真空ポンプと共用することができる。

【００３０】補充槽６１の内部６２には、搬送台６３の搬送方向に沿って一対の支持体６５，６５が設けられており、搬送台６３は、各支持体６５に等間隔に隔置した位置に横軸周りに回転自在に設けられた複数の支持ローラ６６によって支持されている。一方の支持ローラ６６の列（図６で左側）は搬送台６３を直接に支持しており、他方の支持ローラ６６の列（図６で右側）は、後述するラック部材を介して搬送台６３を間接に支持している。各支持ローラ６６の列はラック部材の厚みだけ上下に段差があり、搬送台６３は水平状態に支持される。支持体６５，６５には複数の案内ローラ６７が隔置して縦軸周りに回転自在に配設されており、各案内ローラ６７は、搬送台６３の側面６８，６８に当接して搬送台６３が横振れしないように規制しており、搬送台６３が搬送

されるときに側面６８，６８に対して転がることでその搬送を案内している。真空チャンバ２と補充槽６１との間には通路６９が形成されており、通路６９は後述するゲートバルブ８４によって開閉可能であり、ゲートバルブ８４の開状態で搬送台６３が通路６９を通って移動可能である。

【００３１】搬送台６３を補充槽６１内の装填位置と真空チャンバ２内の進出位置との間で往復動可能に搬送するため補充槽６１には搬送台６３を駆動用の駆動機構７０が設けられている。駆動機構７０は、補充槽６１の外部に設けられたサーボモータのような電動モータ７１と、補充槽６１の底壁６１ａを密封状態に貫通して延び電動モータ７１によって駆動される出力軸７２と、出力軸７２の先端に取り付けられているピニオン７３と、搬送台６３の一方の側部に形成されたピニオン７３と噛み合う歯が形成されたラック７４とから構成されている。駆動機構７０においては、電動モータ７１が運転されると、出力軸７２の回転はピニオン７３とラック７４の噛合い係合を介して搬送台６３の直線運動に変換される。ピニオン７３とラック７４の噛合い係合により、駆動機構７０の構造が簡素に構成され且つ作動が確実となる。搬送台６３は、駆動機構７０によって駆動されるときに、支持ローラ６６と案内ローラ６７とによって横方向と上下方向とに規制され且つ支持ローラ６６と案内ローラ６７とを回転させながら搬送されるので、搬送台６３はスムーズに走行される。

【００３２】使用済の蒸発セル４と未使用の蒸発セル４とを交換する態様で、蒸発セル４を補充槽６１への出し入れを許容するため、補充槽６１には密封可能な開閉扉８０が設けられている。即ち、補充槽６１の上壁６１ｂにはその殆どの広がりに渡って広口孔８１が形成されており、開閉扉８０は広口孔８１を覆う蓋として設けられている。広口孔８１の大きさは、組立当初に搬送台６３自体を取り出したり装着することができる大きさである。開閉扉８０は、取付け具８２によって補充槽６１に圧着状態に取り付けられる。補充槽６１の内部６２を真空化するときに、閉鎖された開閉扉８０と外部との間の密封を維持するため、広口孔８１の周りにはＯリング８３が配設されている。

【００３３】真空チャンバ２と補充槽６１との間に形成されている通路６９に関して、通路６９の開閉状態を切換え可能なゲートバルブ８４が配設されている。ゲートバルブ８４を開閉操作するため、補充槽６１の外部に設けられているアクチュエータ等の操作手段８５の出力軸８６が補充槽６１の底壁６１ａを密封状態に貫通して補充槽６１の内部６２に延びており、出力軸８６の先端部には四辺リンク機構８７を介してバルブ８８が設けられている。操作手段８５の操作によって出力軸８６が上昇し、出力軸８６の上昇に伴ってバルブ８８がストッパ６９ｂに突き当たると、更に上昇する出力軸８６がストッパ６９ｂ（図４）に突き当たるまで、バルブ８８は四辺リンク機構８７を介して通路６９の開口周囲６９ａ（図５）に押し当てられる。バルブ８８の密封面にはＯリング８９（図５）が設けられており、補充槽６１の内部６２の真空を破るときに、真空チャンバ２内の真空に影響がないようにしている。

【００３４】蒸発セル補充機構６０が有機ＥＬ素子製造装置１に適用されると、真空チャンバ２と真空チャンバ２に取り付けられている補充槽６１とのに設けられているゲートバルブ８４を閉じ、通路６９を閉鎖した状態で補充槽６１に設けられている開閉扉８０を開く。補充槽６１に蒸発セル４を載置可能な搬送台６３を収容し、補充用の蒸発セル４を搬送台６３に載置する。搬送台６３が既に補充槽６１に収容されている場合には、開いた開閉扉８０から直ちに蒸発セル４を搬送台６３に載置することができる。その後、開閉扉８０を閉じて補充槽６１を密封する。補充槽６１は、真空チャンバ２に対しても密閉状態とされており、内部６２は単独で再真空化可能である。補充槽６１の内部６２が真空となった状態でゲートバルブ８４が開かれる。ゲートバルブ８４は開状態では搬送台６３の通過を許容するので、搬送台６３は駆動機構７０の作動によって補充槽６１内の戻り位置からから真空チャンバ２内の進出位置へと搬送される。

【００３５】搬送台６３は、搬送方向である水平方向に互いに隔壁して複数列の蒸発セル４を載置可能である。この実施例では、真空チャンバ２内で同時に２つの蒸発セル４，４が使用されるので、３回交換可能なように、２×３の格子状に係止部９０が設けられている。係止部９０は、特に図６に示すように、格子に対応して搬送台６３に形成されている装着孔９１に嵌合され且つ蒸発セル４に係合して位置決めするアダプタとして設けられている。係止部９０は、装着孔９１に嵌合された状態では、その中心部に蒸発セル４の支持棒３６が通る縦の貫通孔９２が形成されており、貫通孔９２は、駆動手段５の垂直方向に上下する昇降筒体２０の先端部に形成されている係合部２１がそのロッドと共に直交状態に挿通可能である。

【００３６】駆動機構７０は、蒸発セル４の交換が行われる毎に搬送台６３を搬送させるためにも用いられる。この場合、搬送台６３の進出位置は、蒸発セル４が各列毎に駆動手段５の係合部２１と係合又は係合離脱する位置まで搬送されることに対応した複数の位置に設定されている。駆動機構７０による搬送で、搬送台６３は、真空チャンバ２内で予め設定された複数の進出位置に順次停止され、搬送台６３に載置された複数列の蒸発セル４，４は、駆動手段５の係合部２１と係合又は係合離脱する位置まで次々に移動される。駆動機構７０によって搬送台６３を真空チャンバ２内に向かって搬送するときに、搬送台６３の進出位置をセンサで検出することにより、蒸発セル４の交換位置への移動を正確に制御するこ

とができる。このように、搬送台６３に搬送方向に隔置して複数列の蒸発セル４，４を載置することにより、蒸発セル４の交換時には、使用済みの蒸発セル４が係止部９０に残留載置される状態で搬送台６３に受け取られた後、駆動機構７０は、搬送台６３を次の進出位置、即ち、次列の蒸発セル４，４が真空チャンバ２内の駆動手段５の係合部２１が昇降する交換位置に達するまで移動させる。補充槽６１において搬送台６３への蒸発セル４の１回の補充又は使用済みの蒸発セル４との交換（６個の蒸発セル４の補充・交換）で、有機ＥＬ素子製造装置１では搬送台６３に載置された列の数だけ複数回（３回）に渡って蒸発セル４を順次交換して使用することが可能である。

【００３７】真空チャンバ２には、真空チャンバ２内に搬送された搬送台６３の先端部を支持する受け部９５が配設されている。受け部９５は、補充槽６１の支持ローラ６６と同じ高さの延長線上に設けられ、搬送台６３の下面を支持する受けローラ９６を備えている。受けローラ９６は、低摩擦にて搬送台６３を支持することができる。搬送台６３は、補充槽６１から真空チャンバ２内に進出したときに、先端部が受け部９５で支持されるので、自重によって傾斜する等の不都合がなく、搬送台６３を水平姿勢に保つことができる。

【００３８】蒸発セル補充機構６０の駆動機構７０によって搬送された搬送台６３が真空チャンバ２内で占める位置では、搬送台６３に設けられている係止部９０の貫通孔９２の位置が駆動手段５の係合部２１の昇降位置と一致する。駆動手段５に作動によって上昇する係合部２１は蒸発セル４と係合して係止部９０の貫通孔９２を通過し、蒸発セル４は、係合部２１によって更に上昇して上昇位置Ｕに運ばれる。上昇位置Ｕでの加熱手段６による蒸発セル４の加熱、中間位置Ｍでの蒸発セル４の冷却等については、既に説明した通りである。有機原料が蒸発し切ると、駆動手段５は蒸発セル４を中間位置Ｍから更に下方の交換位置Ｆまで下降させ、使用済みの蒸発セル４を搬送台６３上の係止部９０に係合した状態に載置させる。駆動手段５は、更に、搬送台６３との干渉を回避可能とするため、係合部２１を交換位置Ｆより下方の下降位置Ｌまで下降させることができる。蒸発セル４を交換するときには、搬送台６３を搬送方向に次にの進出位置まで移動させ、新しい蒸発セル４を係合部２１の昇降位置に移動させればよい。

【００３９】

【発明の効果】この発明による有機ＥＬ素子の製造装置によれば、真空チャンバに取り付けられると共に内部が真空化可能であり且つ外部及び真空チャンバに対してそれぞれ密封状態に閉鎖可能な補充槽と、その補充槽に収容可能であると共に補充用の蒸発セルを位置決め状態に載置する載置部を有する搬送台と、その搬送台を補充槽内の装填位置と真空チャンバ内の進出位置との間で往復可能に搬送する駆動機構とを備え、係合部が、駆動手段によって進出位置に搬送された搬送台の下方の下降位置まで下降可能とし、蒸発セルが、搬送台を上昇通過する係合部と係合して載置部から持ち上げられ、搬送台を下降通過する係合部から係合離脱して載置部に残留載置される構成としたので、外部からの蒸発セルの補充を、有機ＥＬ素子製造装置の運転を停止させず真空チャンバの真空も解除せず維持したまま行うことができ、蒸発セルの補充・交換の後に真空チャンバを再度真空化する必要がなく、有機ＥＬ素子製造装置の運転効率が向上させることができる。また、補充後の蒸発セルを加熱位置まで移動させる機構が、水平方向に搬送される搬送台と、搬送台に対して垂直方向に動作する駆動手段とを有する簡単化された構造から成っているので、補充後の蒸発セルを加熱位置まで簡単な機構で且つ速やかに移動させることができる。その結果、有機ＥＬ素子製造装置の製作コストが低減し、運転効率が向上すると共に、有機原料の蒸発が早期に再開可能になるので、有機ＥＬ素子の製造コストを低減させた有機ＥＬ素子製造装置を提供することができる。また、この有機ＥＬ素子製造装置によれば、蒸発セルの１回の補充で、複数回の蒸発セルの交換を行うことができ、その間、製造装置の運転を停止し真空チャンバの真空を解除したり、運転再開に際して真空チャンバを再度真空化する必要をなくすることもでき、製造装置の運転効率が一層向上し、有機ＥＬ素子の製造コストが更に低減して、有機ＥＬ素子を一層安価に製造することもできる。

【図面の簡単な説明】

【図１】　この発明による蒸発セル補充装置が適用された有機ＥＬ素子製造装置の一実施例を示す縦断面図である。

【図２】　有機ＥＬ素子製造装置に用いられる冷却手段の一例を拡大して示す縦断面であって、図３のＡ－Ａ断面図である。

【図３】　図２に示す冷却手段の平面Ｂ－Ｂでの断面図である。

【図４】　この発明による蒸発セル補充機構を備えた有機ＥＬ素子製造装置の一実施例を示す縦断面図であって、図５のＣ－Ｃ断面図である。

【図５】　図４に示す蒸発セル補充装置の平面Ｄ－Ｄでの断面図である。

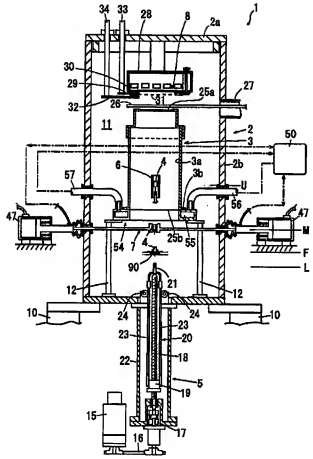
【図６】　図４に示す蒸発セル補充装置の平面Ｅ－Ｅでの断面図である。

【符号の説明】

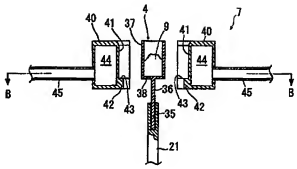
１	有機ＥＬ素子製造装置	２	真空チャンバ
２ｂ	周壁部	３	蒸発筒
４	蒸発セル	５	駆動手段
６	加熱手段	７	セル冷却手段

８	基板	９	有機原料	７３	ピニオン	７４	ラック
１１	真空チャンバの内部	２１	係合部	８０	開閉扉	８４	ゲートバルブ
４０	セル冷却体						
６０	蒸発セル補充機構	６１	補充槽	９０	係止部	９２	貫通孔
６２	内部	６３	搬送台	９５	受け部		
６６	支持ローラ	６８	側部	Ｕ	上昇位置	Ｍ	中間位置
７０	駆動機構	７１	駆動モータ	Ｌ	下降位置	Ｆ	交換位置

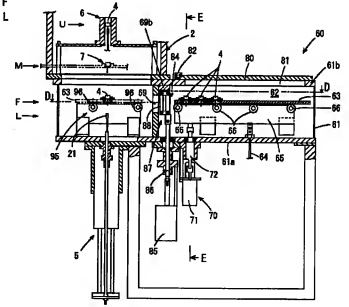
【図１】



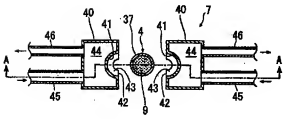
【図２】



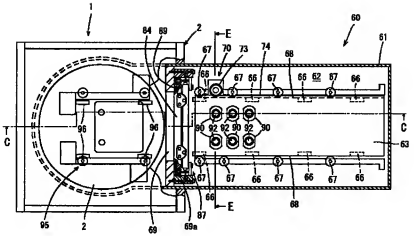
【図４】



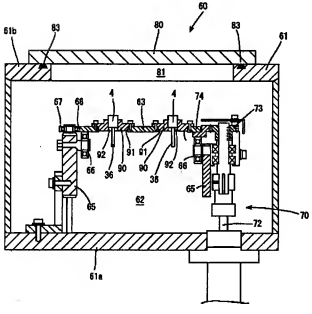
【図３】



【図５】


1
84
89
2
E
67
70
73
74
68
60
51
67
65
67
65
62
67
66
C
C
96
90
92
92
92
90
30
63
67
67
66
67
66
67
66
66
E
95
2
69
69a
87
68

【図６】


60
61b
83
80
83
61
81
67
68
4
63
4
74
73
92
91
61
66
90
90
92
66
36
36
65
62
65
70
72
61a